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A NEW CRAYFISH FROM ALABAMA, WITH NOTES ON PROCAMBARUS LECONTEI (HAGEN)

By Horton H. Hobbs, Jr.

The combined ranges of the members of the Blandingii section of the genus *Procambarus*, excluding mountainous areas, extend from Mexico to Massachusetts, and from Florida to Ohio and Minnesota. The new species described herein is found in a region in which the members of this section have shown the greatest degree of speciation (i. e., in the southeastern part of the United States). Since the species is represented in my collection by only six specimens, taken from the type locality, little is known of its habits and variation, and its range can be postulated only in terms of the known distribution of its close relatives, which presumably have similar habitat preferences. On the basis of the latter it seems probable that it is confined to the Tallapoosa River and its tributaries.

Procambarus lecontei (Hagen, 1870, p. 47) has never been adequately diagnosed, and the published figures (first pleopods, antennal scale, and epistome by Hagen, 1870, and dorsal aspect by Faxon, 1885a) are inadequate and not entirely accurate. Furthermore, since its original description there has been considerable confusion as to its range. In addition to presenting a revised diagnosis of *P. lecontei* and illustrating the diagnostic features, I am including a bibliography of the species and summarizing its known range.

I wish to express my gratitude to Dr. E. C. Raney, R. D. Suttkus, and J. Kezer, of Cornell University, for the gift of the specimens on which the new species is based, as well as to others, mentioned in connection with collection data, who have assisted in collecting specimens of *P. lecontei*.

Abbreviations used to indicate repositories of specimens are as follows:

HHH, my personal collection at the University of Virginia. Note that the date collected may be obtained from the catalog number—6–1649–2a, specimens were collected on June 16, 1949.

MCZ, Museum of Comparative Zoology.

TU, Tulane University.

U.S.N.M., United States National Museum.

Genus PROCAMBARUS Ortmann

Cambarus Ortmann, 1905b, p. 437.

PROCAMBARUS LECONTEI (Hagen)

Figure 81

Cambarus lecontei Hagen, 1870, pp. 10, 45–47, 48,[1] 52, 97,[1] 106,[1] 107 (pp. 100, 101, and 106 not *lecontei*), figs. 15, 18, 145.—Creaser, 1934, p. 4.—Faxon, 1884, pp. 110, 137; 1885a, pp. 17, 19, 22, 24, 29–30,[1] 31, 32, 33, 158,[1] 167,[1] 168,[1] 173, pl. 2, fig. 2; 1885b, p. 358; 1914, p. 413.—Harris, 1903, pp. 58,[1] 107,[1] 138,[1] 144, 151 (pp. 143 and 152 not *lecontei*).—Hay, 1899, pp. 959, 963.—Ortmann, 1902, p. 277; 1905a, pp. 102, 129.

Procambarus lecontei Hobbs, 1942b, p. 342 (by implication); 1942c, pp. 94, 95, 98.

Diagnosis.—Rostrum with lateral spines; areola moderately broad with four or five punctations in narrowest part; cephalothorax granulate laterally, punctate dorsally; a single lateral spine present on each side of carapace. Male with hooks on ischiopodites of third and fourth pereiopods; palm of chela of first-form male not bearded but bearing a row of seven to nine tubercles on inner margin; postorbital ridges terminating cephalad in spines. First pleopod of first-form male with no marked hump on cephalic surface but with a noticeable "knob" on lateral surface opposite the caudal process; tip terminates in four distinct parts (of which all except caudal process are directed caudad at approximately a right angle to main shaft of appendage): mesial process long, slender, subcylindrical, noncorneous, lies considerably proximad of and extends much farther caudad than the other terminal elements; cephalic process moderately short, compressed, corneous, and somewhat hoods the more prominent central projection; caudal process slender, somewhat flattened, corneous, lies proximad of the central projection, and is directed at about a 45° angle to the main shaft of the appendage; central projection compressed, corneous, beaklike, and extends slightly farther caudad than either cephalic or caudal processes. Annulus ventralis as in fig. 81, *d*, decidedly broader than long with a prominent raised area on cephalolateral (dextral or sinistral) side of sinus; sternum immediately cephalad of annulus with multituberculate prominences which extend caudad to cover a portion of annulus.

[1] In part, excluding records from Georgia, Florida, Mississippi, and North Carolina.

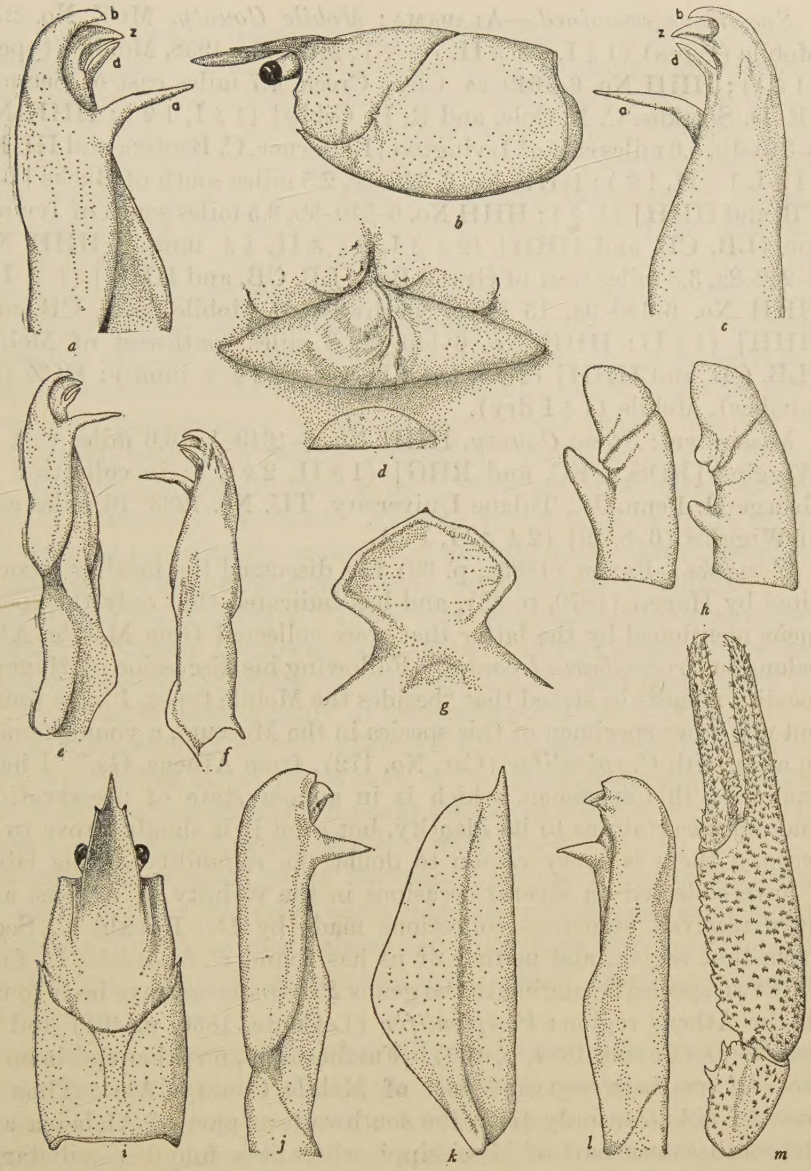

FIGURE 81.—*Procambarus lecontei* (Hagen), from Moores Creek, 8 miles southwest of Mobile on United States Highway 90, Mobile County, Ala.: *a*, Mesial view of first pleopod of male, form I; *b*, lateral view of carapace of male, form I; *c*, lateral view of first pleopod of male, form I; *d*, annulus ventralis; *e*, mesial view of first pleopod of male, form I; *f*, lateral view of first pleopod of male, form I; *g*, epistome of male, form I; *h*, basipodites and ischiopodites of third and fourth pereiopods of male, form I; *i*, dorsal view of carapace of male, form I; *j*, mesial view of first pleopod of male, form II; *k*, antennal scale of male, form I; *l*, lateral view of first pleopod of male, form II; *m*, upper view of chela of male, form I. a=Mesial process; b=cephalic process; d=caudal process; z=central projection. Pubescence removed from all structures illustrated except *m*.

Specimens examined.—Alabama: *Mobile County*, MCZ No. 217, Mobile (types) (1 ♂ I, 2 ♂ ♂ II, 7 ♀ ♀); MCZ No. 4958, Mobile (types) (1 ♂ I); HHH No. 6–1649–2a, Clear Creek, 4.7 miles east of Semmes [R. D. Suttkus, C. F. Cole, and R. H. Gibbs] (1 ♂ I, 1 ♀); HHH No. 6–340–1b, 5.6 miles east of Irvington [L. Berner, C. Benton, and HHH] (1 ♂ I, 1 ♂ II, 1 ♀); HHH No. 6–340–9c, 2.5 miles south of Bucks [LB, CB, and HHH] (1 ♀); HHH No. 6–240–5b, 3.5 miles south of Irvington [LB, CB, and HHH] (2 ♂ ♂ I, 2 ♂ ♂ II, 1 ♂ imm.); HHH No. 6–240–2a, 3.8 miles west of Grand Bay [LB, CB, and HHH] (1 ♂ I); HHH No. 6–140–9a, 15 miles southwest of Mobile [LB, CB, and HHH] (1 ♂ I); HHH No. 6–140–8a, 8 miles southwest of Mobile [LB, CB, and HHH] (2 ♂ ♂ I, 1 ♂ II, 2 ♀ ♀, 2 ♀ ♀ imm.); MCZ (no number), Mobile (1 ♂ I dry).

Mississippi: *Stone County*, HHH No. 6–1649–1, 16.6 miles east of Wiggins [RDS, CFC, and RHG] (1 ♂ II, 2 ♀ ♀); in collection of George H. Penn, Jr., Tulane University, TU. No. 1233, 16 miles east of Wiggins (6/8/49) (2 ♂ ♂ II, 1 ♀).

Remarks.—Faxon (1885a, p. 30) has discussed the locality records cited by Hagen (1870, p. 48), and has indicated that only the specimens mentioned by the latter that were collected from Mobile, Ala., belong to *Procambarus lecontei*.[2] Following his discussion of Hagen's locality records he stated that "besides the Mobile types, I have found but one other specimen of this species in the Museum, a young female in a jar with *C. spiculifer* (Cat. No. 172), from Athens, Ga." I have examined this specimen, which is in a poor state of preservation, and am uncertain as to its identity, but even if it should prove to be *lecontei* there is every reason to doubt the reliability of the label. I have collected on several occasions in the vicinity of Athens, and have received numerous collections made by Dr. Donald C. Scott from that region, and neither of us has found *P. lecontei*. In fact, only two species belonging to the genus *Procambarus* have been found in the Athens region: *P. spiculifer* (LeConte, 1856, p. 401) and *P. pubescens* (Faxon, 1884, p. 109). Furthermore, no other specimen of *lecontei* has been reported east of Mobile County, Ala. Thus *P. lecontei* is known only from the southwestern part of Alabama and the southeastern part of Mississippi, where it is found in tributaries of the Mobile and Pascagoula Rivers.

PROCAMBARUS VERRUCOSUS, new species

Figure 82

Diagnosis.—Rostrum with small lateral spines or tubercles, which set off the acumen from basal portion; areola moderately narrow with

[2] I may add that the specimens from Pensacola, Fla., which Faxon stated were not *lecontei* but of which he made no specific determination, are *Procambarus evermanni* (Faxon, 1890, p. 620) [MCZ No. 249].

three punctations in narrowest part; cephalothorax markedly granulate laterally and in the caudal portion of the areola; a single lateral spine present on each side of carapace. Male with hooks on ischiopodites of third and fourth pereiopods; palm of chela of first-form male not bearded but bearing a row of seven to nine tubercles along inner margin; postorbital ridges terminating cephalad in spines. First pleopod of first-form male with a rounded hump on cephalic margin near distal end, and terminating in four distinct parts: The noncorneous mesial process prominent, acute, and extends caudodistad, and laterad of the other terminal elements; the small, corneous, acutely triangular cephalic process arises from middistal end of appendage; caudal process corneous, and flattened cephalocaudad, corneous, subtriangular, and concave in caudal aspect, and closely applied to caudolateral surface of central projection; central projection corneous, slender, and terminating bluntly, directed caudodistad as are cephalic and caudal processes. Annulus ventralis as in figure 82, *d*, and sternum immediately cephalad of annulus with multituberculate prominences, which extend caudad to cover portion of annulus.

Holotypic male, form I.—Body subovate, somewhat compressed laterally; abdomen narrower than thorax (12.9–14.6 mm. in widest parts, respectively); width of carapace slightly less than depth in region of caudodorsal margin of cervical groove (14.6–15.0 mm.).

Areola moderately narrow, about 7.3 times longer than broad with three punctations in narrowest part, caudal third granulate; cephalic section of carapace about 2.1 times as long as areola (length of areola about 31.9 percent of entire length of carapace).

Margins of rostrum gently converging cephalad, and terminating at base of acumen in a small acute tubercle on each side; acumen not upturned; rostrum excavate above and without swollen margins, and studded with many inconspicuous setae arising from very minute punctations.

Postorbital ridges grooved laterally, and terminating cephalad in acute spines; subrostral ridges moderately well developed, but evident in dorsal aspect only at base; suborbital angle small and obtuse; branchiostegal spine well defined and acute; sides of carapace with an acute spine on each side. Surface of carapace granulate except for cephalodorsal portion of carapace and cephalic two-thirds of areola which are punctate.

Abdomen longer than thorax (34.7–31.9 mm.).

Cephalic section of telson with two spines in each caudolateral corner. Outer dextral spine bidentate.

Epistome semiovate with a distinct cephalomedian projection; entire margin bearing plumose setae.

Antennule with a strong spine on ventral surface of basal segment.

Antenna broken, but in other specimens extends caudad to fourth abdominal segment; antennal scale broad with a well-developed spine on outer distal margin; lamellar portion rounded mesially, and broadest proximad of middle (fig. 82, *k*).

Right chela slender, with inflated palm; palm studded with setiferous tubercles on all surfaces. Inner margin of palm with a row of nine tubercles which are only slightly more prominent than others flanking this row. In addition to squamous tubercles on lower surface of palm a distinctly larger tubercle present near base of dactyl. Fingers not gaping. Opposable margin of immovable finger with a row of three small tubercles on basal fifth, the distal one largest; a strong tubercle extends mesiad from lower opposable margin near midlength of finger; otherwise opposable margin with crowded minute denticles. Opposable margin of dactyl with 2 proximal rows of rounded tubercles: an upper row of 10 and a lower one of 6; between and distad of these 2 rows are crowded minute denticles. A low longitudinal ridge present on upper surface of both fingers; all surfaces of fingers with setiferous punctations except along proximomesial portion of dactyl where squamous tubercles occur in basal sixth.

Carpus of first right pereiopod about 1.7 times longer than broad with the usual oblique furrow on upper surface represented by a broad shallow depression; all surfaces with squamous tubercles, more abundant in mesial half of segment; mesial surface with an oblique row of three spikelike tubercles. Lower mesiodistal margin with a strong acute tubercle, and a similar one on lower laterodistal margin.

Merus of first right pereiopod with 2 irregular rows of tubercles on upper margin and a few scattered ones between; 2 strong acute tubercles in distal portion; lateral surface with scattered punctations; lower surface with two rows of tubercles: lateral row of 14 and mesial row of 16, and in addition a few tubercles on both sides of these 2 rows.

Ischiopodites of third and fourth pereiopods with hooks; hooks simple, that on third extending proximad of ischiopodite, and that on fourth opposed by a tubercle on basipodite. Coxopodites of fourth and fifth pereiopods with ventrally projecting prominences: those on fourth swollen, and those on fifth smaller and less bulbiform.

First pleopods symmetrical and reaching coxopodite of third pereiopod when abdomen is flexed. (See description of pleopod under *Diagnosis*.)

Morphotypic male, Form II.—Differs from the holotype in the following respects: Rostrum more contracted distally; caudal portion of areola punctate; all spines on telson simple; mesial row of tubercles on

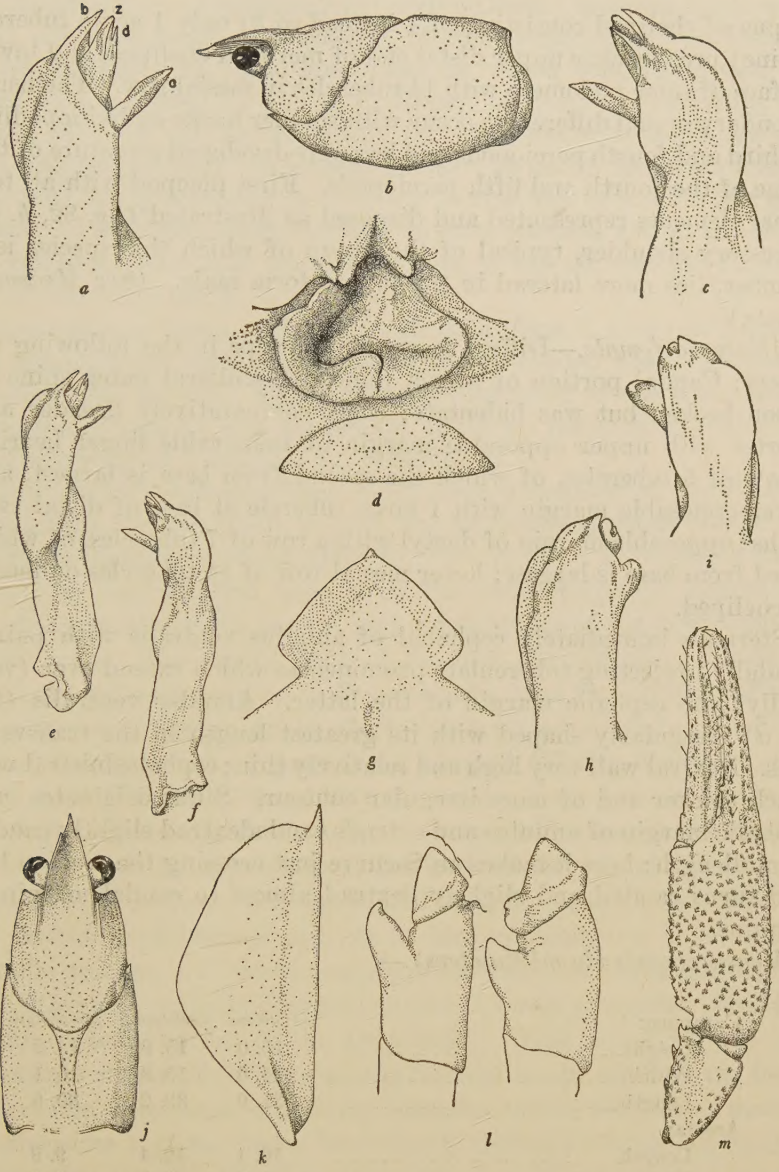

FIGURE 82.—*Procambarus verrucosus*, new species: *a*, Mesial view of first pleopod of holotype; *b*, lateral view of carapace of holotype; *c*, lateral view of first pleopod of holotype; *d*, annulus ventralis of allotype; *e*, mesial view of first pleopod of holotype; *f*, lateral view of first pleopod of holotype; *g*, epistome of holotype; *h*, mesial view of first pleopod of morphotype; *i*, lateral view of first pleopod of morphotype; *j*, dorsal view of carapace of holotype; *k*, antennal scale of holotype; *l*, basipodites and ischiopodites of third and fourth pereiopods of holotype; *m*, upper view of chela of holotype. a=Mesial process; b=cephalic process; d=caudal process; z=central projection. Pubescence removed from all structures illustrated except *m*.

carpus of cheliped consisting of 4 instead of 3; only 1 acute tubercle (spine) present near upper distal end of merus of cheliped, and lower surface of same podomere with 14 tubercles in mesial row. The usual secondary sexual differences occur with smaller hooks on ischiopodites of third and fourth pereiopods and less well-developed armature of the coxae of the fourth and fifth pereiopods. First pleopod with all terminal elements represented and disposed as illustrated (fig. 82, *h*, *i*). Accessory shoulder, typical of the group of which this species is a member, lies more laterad in the second-form male. (See *Measurements.*)

Allotypic female.—Differs from the holotype in the following respects: Caudal portion of areola punctate; sinistral outer spine of telson broken but was bidentate; chela comparatively broader and shorter with upper opposable margin of immovable finger bearing a row of 5 tubercles, of which the second from base is largest, and lower opposable margin with 1 large tubercle at base of distal two-fifths; opposable margin of dactyl with a row of 7 tubercles, of which third from base is largest; lower mesial row of 14 tubercles on merus of cheliped.

Sternum immediately cephalad of annulus ventralis with paired caudally projecting tuberculate prominences which extend over (ventrally) the cephalic margin of the latter. Annulus ventralis (fig. 82, *d*) irregularly shaped with its greatest length in the transverse axis. Dextral wall very high and relatively thin; cephalosinistral wall much thicker and of more irregular contour. Sinus originates near cephalic margin of annulus and extends caudodextrad slightly caudad of midlength; here it makes an S-curve just crossing the median line and turns caudad and slightly dextrad almost to caudal margin of annulus.

Measurements (in millimeters).—

	Holotype	*Allotype*	*Morphotype*
Carapace:			
Height	15. 0	15. 9	14. 2
Width	14. 6	15. 8	15. 1
Length	31. 9	33. 2	30. 6
Areola:			
Length	10. 1	10. 4	9. 9
Width	1. 5	1. 5	1. 4
Rostrum:			
Length	9. 0	9. 2	8. 6
Width	6. 4	5. 6	5. 3
Right chela:			
Length, inner margin of palm	10. 9	6. 1	7. 3
Width of palm	6. 9	6. 0	4. 6
Length, outer margin of hand	28. 2	17. 0	19. 2
Length of dactyl	15. 3	10. 1	10. 5

Type locality.— A tributary of Calebea Creek [Alabama River system], 3.9 miles south of Tuskegee, Macon County, Ala., on United States Highway 29. The specimens on which this description is based were collected by Dr. E. C. Raney, of Cornell University, on March 24, 1948, and he has kindly furnished me with the following data: At this locality the stream is clear, about 10 feet wide and 3 feet deep, sandy-bottomed, and with a volume flow of 5 cubic feet per second. The stream flows through an open pasture, and at the time the collection was made the temperature of the air was 80° F., and that of the water 65° F.

Disposition of types.—The holotypic male, form I, allotypic female, and morphotypic male are deposited in the United States National Museum (No. 90743). The paratypes, consisting of one male, form I, one male, form II, and one female, are in my personal collection at the University of Virginia (No. 3–2448–3b).

Relationships.—*Procambarus verrucosus*, a member of the Blandingii group (Hobbs, 1942b, p. 341), has its closest affinities with *Procambarus blandingii acutus* (Girard, 1852, p. 91). However, it may readily be distinguished from it by the more complexly appearing annulus ventralis of the female, and the structure of the first pleopod of the male. The *caudal knob* of the first pleopod has assumed a markedly different position in *P. verrucosus* from that in some of the other species of this group, in which this knob more closely resembles that of the hypothetical generalized pleopod (Hobbs, 1942a, p. 58). In *P. hayi* (Faxon, 1884, p. 108) the caudal knob (which has been prolonged proximally into a long irregular fold) lies on the caudolateral face of the appendage at the base of the caudal process; in *P. blandingii acutus*, while the caudal knob is distinctly knoblike, it has shifted caudolaterad and lies at the cephalolateral base of the cephalic process; in *P. verrucosus* there has been a still stronger degree of shifting in a cephalic direction so that it forms a rounded shoulder on the cephalic border of the appendage. Were it not for the intermediate stages of shifting of the "caudal knob" which have been observed in specimens tentatively identified as *P. blandingii acutus* (a subspecies that has never been clearly defined) one would hardly suspect that the "shoulder" on the pleopod of *P. verrucosus* had any relationship to that of the more "typical" caudal knob as occurs in *P. pictus* (Hobbs, 1940, p. 419) and the "less typical" one in *P. hayi.*

Remarks.—The annulus ventralis of the allotype contains a sperm plug, which indicates that this species breeds in the early spring; however, it should be pointed out that this does not mean that this species does not breed during summer, fall, or winter.

Collected with *P. verrucosus* in the type locality were five specimens of *P. versutus* (Hagen, 1870, p. 51).

The name *verrucosus* refers to the granulate condition of the carapace.

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